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ATTACHMENT 26

Description of Wastewater Treatment Process

HILMAR CHEESE COMPANY
(HCC)

Wastewater Treatment Description

July 2004

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Section 1: Executive Summary

1.1 The updated wastewater treatment system at HCC has been designed to process up to 2 mgd (7570 m^3/day) of manufacturing wastewater. The system is not exposed to or contaminated by any human wastes - these are treated separately under a septic tank system overseen by Merced County. The treatment plant design is based on environmentally sustainable practices to:

- Minimize the use of non renewable energy (electricity and natural gas)
- Minimize cleaning chemical usage
- Convert organic components into green house friendly biogas to supplant some on site non-renewable energy requirements
- Produce stable residues (biosolids) for conversion to soil amendments
- Safely dispose of residual mineral laden treated water to confined, deep, saline groundwaters

1.2 The treatment process involves:

- Equalization of incoming wastewater
- Physico-chemical dissolved air floatation (primary treatment)
- Anaerobic digestion (secondary treatment)
- Aerobic polishing (tertiary treatment)
- Deep Well Injection

1.3 The design includes provision of capacity for spills and maintenance requirements to ensure appropriate treatment and disposal.

1.4 The new treatment system will produce effluent with less than 50 mg/L each of biochemical oxygen demand (BOD) and total suspended solids (TSS), and less than 10 mg/L TKN, 2 mg/L NH_4 - N and 2 mg/L NO_3 – N. **(See note about potential to increase N values if allowable with deep well injection)**

1.5 Treated effluent from the new process will be injected via a deep well into a confined saline aquifer. An effluent with a specific conductance of 2000 - 2200 μmhos/cm is anticipated **(see note – this will need to be verified as we have not yet accounted for brine inclusion)**. Monitoring will be put in place to record the volumes and composition of the injectate and the injection pressures. Sufficient emergency storage and will be maintained to ensure that during routine or emergency well maintenance wastewater will not be spilt.

1.6 Following completion of the new wastewater treatment facilities there will be a time lag until the deep well injection systems are established. Until the deep wells are established, it is planned to process treated effluent from the new system through the existing reverse osmosis (RO) equipment. During this transitional phase the ROs will be used to remove minerals from the effluent. After RO treatment, the effluent will be of reclaimed water quality. This filtrate water will be irrigated onto the current primary and secondary lands (550 acres) defined in the 2001 RWD and under current reporting to the RWQCB. These lands are serviced by the existing effluent storage and distribution system. The reclaimed water is projected to meet the lesser of water quality objectives or local background water quality, values of which will be presented in the Report of Waste Discharge (RWD). Reclaimed water with a specific conductance of less than 900 μmho/cm is anticipated. The retentate form the ROs will be blended with DAF float materials and sent to EBMUD for processing in their system.

1.7 It is HCC's experience that the use of reverse osmosis is not a practicable or desirable final treatment step on this site in the long term, as it conflicts with environmental goals to reduce importation of chemicals and consumption of non-renewable energy. The company's experience has shown the operation of ROs to be encumbered with excessive running costs, fouled membranes, increased use of cleaning chemicals and a lack of a practicable and economic disposal sites for the concentrated minerals.

1.8 In the longer term, as the deep wells are made ready for acceptance of processed water from the aerobic polishing stage, the volume run through reverse osmosis equipment will be diminished. The conversion from the initial reuse plan (using ROs), to the long-term plan (deep well injection), is expected to take up to two years and would be completed by July 2006.

Section 2: Wastewater Treatment Processes

Section 2.1 General Descriptions

Refer to the attached schematic process flow

2.1.1 **Collection Pits** – three main collection pits are used to collect water from the processing plants. The 'Cheese Pit' collects wastewater from the cheese, protein and milk receiving areas. The 'Lactose Pit' collects wastewater from the lactose plant and the 'Wastewater Pit' collects from the truck washes and waste treatment areas. Pumps transfer wastewater from these pits to the equalization tanks. Three pumps are located in the cheese and lactose pits and are run sequentially as the flows increase. In line flow and pH meters are installed downstream of the pumps and this data is continuously recorded.

2.1.2 **Acid Reclaim (not shown on the schematic)** – an acid reclaim system is used to recycle spent acid from the cheese and protein plants to use on cleaning of the lactose evaporator. After reuse, the 'dirty acid' is collected and either trucked off-site by a licensed contractor (Triad) for use in soil amendments, or it is sent to drain for processing through the waste treatment plant.

2.1.3 **Equalization** – two main equalization tanks (EQ 1 & EQ 2) are used to equalize flow and pH of the wastewater flows. Each tank has a volume of 350,000 gal. (1325 m^3) and can be run in parallel or in series depending on the desired outcome of the equalization process. Each tank is fitted with a 5000 gpm (18.9 m^3/min.) Flygt mixer to ensure rapid mixing of the incoming wastewater. A third equalization tank, EQ 3 (also 350,000 gal. in size), is available to take loads from unplanned events. EQ 3 tank will be fitted with eight venturi aerators to aerate these loads before they are fed back into the main system. This tank also contains a Flygt mixer. Output from EQ 3 can be fed back into EQ 1 & 2, EGSB, PA, and SBR 1 & 2 as required to optimize treatment.

2.1.4 Physico-Chemico Dissolved Air Floatation (PCDAF) – after pH, temperature and load has been attenuated in the EQ tanks to the desired level the wastewater is gravity fed to two 55,000 gal. (208-m^3) PCDAF tanks. A primary flocculant and polymer is added at the EQ tank outlet to flocculate and coagulate the suspended solids in the wastewater. The wastewater passes through a mix well then into the PCDAF tanks. These tanks can be run in parallel or in series depending on the load demands and needs for maintenance. Each tank has the hydraulic capacity to run 2 mgd (7570 m^3/day). PCDAF float is scraped from the top of the PCDAF tanks and transferred to a balance tank before feeding the fat digester or the filter press. The option to bypass the PCDAF with a low TSS stream (e.g. equalized lactose pit wastewater) will be retained. This bypass stream would pass directly to the Expanded Granular Sludge Bed (EGSB) if required.

2.1.5 Lipid Digester – a proprietary lipid digester is being designed to take the DAF float and anaerobically digest it to produce biogas. The outflow from this will be fed to the main anaerobic digester (EGSB). The lipid digester is proposed to be approximately 500,000 gal. (1893 m^3) in size and have an HRT of approximately 20 days to ensure extensive breakdown of the fats. Final design criteria and overall feasibility are still being reviewed at this time. Biosolids from this digester will be pumped to the biosolids holding tank prior to passing into the filter press to remove water. Until this digester is installed, the PCDAF float will continue to be sent to external composting and/or municipal digesters.

2.1.6 Anaerobic Digester (EGSB) – a proprietary designed Expanded Granular Sludge Bed anaerobic digester (EGSB) will take the outflow from the PCDAF system. This 500,000 gal. (1893 m^3) digester is designed for a flow of 2 mgd (7570 m^3/day) and loading rates as described in the design parameters section 2.2 below. In essence it will remove 85-90% of the BOD load in the wastewater through the anaerobic conversion of organics into biogas (predominantly methane). Biogas gas from the EGSB will be collected and either burnt in a permitted flare or used to fire boilers or other equipment currently using natural gas. Biosolids from this will be sent to the biosolids handling area for dewatering and removal from site. The EGSB is completely sealed and does not leak malodorous gases to the atmosphere.

2.1.7 Pre-Aeration (PA) – a fully enclosed, roofed, 1,000,000 gal. (3785 m^3) pre-aeration tank is designed to remove malodors from the EGSB effluent. The extracted air in the tank roof space will then be passed through a soil bed bio-filter to remove any malodors. The PA is the first stage of the aerobic polishing of the wastewater. Flow through this pre-aeration tank is continuous. As a conservative design approach, no allowance for treatment of BOD and N content in this pre-aeration stage has been made in the overall design calculations, even though some will occur. The ability to add aeration capacity to the PA tank has been planned through the addition of spare connections and tank penetrations, should additional treatment capacity prove to be required.

2.1.8 Sequenced Batch Reactors (SBR) – two 1,000,000 gal. (3785 m^3) SBRs take the effluent from the pre-aeration tank and run through 4 cycles each per day (6 hours per cycle). Their primary function is to reduce BOD and N levels to design limits as described in section 2.2. Biosolids from these tanks will be collected and transferred to the biosolids handling area for dewatering and removal from site. Outflow from these SBRs will either go to the reverse osmosis system for filtration (initial phase) or be sent directly to storage in a lined holding pond or tank before deep well injection (long term). If emergency storage for SBR outflow is required (e.g during well maintenance) two existing clay lined ponds will be used to store the treated effluent. These have 40,000,000 gallon or 20 days total storage capacity.

2.1.9 **Biosolids Handling** – Biosolids from the EGSB and SBRs will be collected in a 50,000 gal. (190 m^3) holding tank then dewatered in a filter press for transport to local compost operations. The biosolids do not contain or high levels of human pathogens or other potentially harmful contaminants so it is suitable for a range of composting end uses. In the short term, prior to the installation of the lipid digester, a proportion of the PCDAF float will also be processed through the filter press and sent to composting and/or an external digester. These currently comprise two local composting operations and the digester at EBMUD. Any PCDAF float that cannot be put through the filter press will also be sent in its dilute form to external compost or digester operations.

2.1.10 **Deep Well Injection** – Outflow from the SBRs, after temporary storage in the lined holding pond or tank, will be directly injected into deep wells. These wells are described in detail elsewhere, but in brief the system is as follows. A series of deep wells will be drilled to an approximate depth of 4000 feet. Between 3300 to 4000 feet a layer of Paleocene through Upper Cretaceous Sands exists in the injection area with a net sand injection depth of 520 feet. This injection zone is overlain by approximately 100 feet of Kreyenhagen Shale and underlain by approximately the same depth of Hall shale. Saline water is measured at a depth of 1500 feet. A series of wells will be drilled to accommodate the full flow of treated effluent. 4 wells have been calculated to accommodate 2 mgd for a period in excess of 20 years with a radius of influence of approximately 1250 feet.

2.1.11 **Sand Filtration and Chemical Addition -** The final effluent quality is still to be proved. Contingent upon this, design consideration has been given to the inclusion of sand filtration just prior to injection to remove any excess remaining suspended solids. These will be used just after withdrawal of effluent from the holding pond and prior to injection. In addition, if any chemicals are required to sustain well performance (e.g. microbial inhibitors), then these will be metered into the injectate just prior to the well head from a bulk supply. These are shown on the schematic diagram.

2.1.12 **Processed Water Irrigation** – In the event that a massive failure of the deep well injection should occur, the company is applying for permits from the RWQCB to land apply effluent from the SBRs and or effluent after RO treatment. A range of factors has been taken into account to calculate the mineral and organic loads that can be applied in this manner to any given area of land without degradation of the groundwater. The application of processed water with BOD and TSS concentrations below 50 mg/L is well within acceptable levels, particularly since the level of soluble BOD is projected to be $\leq$ 10 mg/L. In terms of mineral loadings, the antidegradation model uses conservative plant uptake levels and removal rates, adsorption and desorption processes, transformations and background water quality to calculate loading rates to enable the receiving water quality to be maintained.

In detail, reclaimed water from the SBRs will be discharged to clay-lined ponds for storage until it is irrigated to land – these total approximately 40,000,000 gal. (151,400 m^3) in size at the Lander Avenue site. Stored water will be applied to land growing field crops (typically corn, oats, alfalfa and pasture) to supply their growing needs. The rate of application will be determined by standard irrigation practices for the crops and the quality of water required to maintain the soil environment.

2.1.13 Brine Disposal (not shown on schematic) – brine from the water softeners used on the well water will be added to the treated effluent from the SBRs prior to deep well injection. Currently Safety Kleen collects the brine and takes it to their San Jose disposal plant. Volumes for this vary from 40,000 to 100,000 gallons per year depending on the demand for softened well water and the running of the product water recycling ROs.

2.1.14 Reverse Osmosis – The ability to process some SBR outflow through reverse osmosis will be retained in the short term. This capacity will be used until the deep well injection system is operational. As advised in previously the reliance on use of additional chemicals and use of non-renewable energy makes this an undesirable option for the long term. In addition, the severe fouling of the RO membranes also makes them impractical to run in the long term. For instance, the recommended maximum levels of silica in water to prevent RO membrane fouling are 10 mg/L. One of HCC's wells is over 60 mg/L and addition of other materials to the wastewater for treatment purposes increases this further.

Although these issues deter the company from using ROs in the long term, it accepts that their use in the short term is desirable to ensure an improved level of environmental performance whilst the longer-term solution is developed.

The current RO system consists of two large primary ROs of nominally 640 gpm (2.423 m^3/min) capacities each. It must be noted that these units were not originally designed to process post-SBR wastewater. Actual running of the post SBR water on the ROs will need to verify the final true capacity under these conditions. With a cleaner feed than is currently being run we expect to achieve longer runs with less cleaning and predict our capacity will increase to 1,500,000 – 1,650,000 gpd (5678 – 6246 m^3/day) of process water running at a 10 x concentration. Concentrate from this, approximately 150,000 gpd (568 m^3/day) will be passed through a 180 gpm (0.68 m^3/min) secondary RO. Concentrate from this (approximately 50,000 gpd at 3 x concentration) will be run to the evaporator. Permeate from the secondary RO will be recycled back into the primary ROs.

2.1.15 Evaporation – the current evaporator will be used to process the secondary RO concentrate. Condensate from this will be fed into the primary RO permeate (processed water) whilst the concentrate will be mixed with DAF float and sent to an external digester (e.g. EBMUD). The evaporator has a nominal capacity of 70 gpm when fed with the secondary RO concentrate. This equates to a daily capacity of 84,000 gpd (318 m^3/day).

2.1.16 **Soil Bed Biofilter** – the initial design for this filter has been completed. The air from the PA will be driven through a 1600 ft^2 (149 m^2) soil bed biofilter. Construction of this is due to begin in June and completed in time for full flow from the PA in July 2004. The filter purifies malodorous compounds from the air thereby reducing the risks of any nuisance conditions.

2.2 Design Parameters

Table 1 below details the design criteria for the first stage of the PCDAF / EGSB / PA / SBR processes. In keeping with the conservative design approach, the capability to increase aeration capacity has been incorporated in the design. This expanded capacity is not detailed here, but will be in the detailed submission to follow.

Table 1: HCC wastewater treatment plant design – combined mass flows.

Item	Raw Wastewater		Ex DAF		Ex EGSB		Ex SBR	
	Current Flow	Full Flow	Current Flow	Full Flow	Current Flow	Full Flow	Current Flow	Full Flow
Design Flow (gal/day) (m^3/day)	**1.4 m** 5300	**2.0 m** 7570	**1.4 m** 5300	**2.0 m** 7570	**1.4 m** 5300	**2.0 m** 7570	**1.4 m** 5300	**2.0 m** 7570
COD (lbs/day) (kg/day)	**51841** 23500	**88184** 40000	**46738** 21200	**72311** 32800	NA	NA[2]	NA	NA
BOD [1] (lbs/day) (kg/day)	**32408** 14700	**45305** 20550	**31636** 14350	**45194** 20500	**2337** 1060	**3336** 1513	**586** 266	**838** 380
Fat (lbs/day) (kg/day)	**7716** 3500	**11023** 5000	**716** 325	**716** 325	**44** 20	**66** 30	**57** <26	**84** <38
TKN (lbs/day) (kg/day)	**1182** 536	**1687** 765	**1157** 525	**1653** 750	**1102** 500	**1543** 700	**234** 106	**333** 151
NH_3-N (lbs/day) (kg/day)	**514** 233	**728** 330	**115** 52	**1552** 704	**776** 352	**1552** 704	**24** 11	**35** 16
NO_3-N (lbs/day) (kg/day)	**432** 196	**617** 280	**432** 196	**617** 280	**18** 8	**22** 10	**24** 11	**35** 16
TSS (lbs/day) (kg/day)	-	-[3]	**1168** 530	**16689** 7570	**3505** 1590	**5004** 2270	**57** 26	**84** 38
Calculated Spare Capacity for the Unit Processes								
			DAF		**EGSB**		**SBR**	
Fat (lbs/day) (kg/day)				**22046** 10000				
BOD - 24 hr max (lbs/day) (kg/day)						**78484** 35600		**25353** 11500[4]
BOD - 72 hr max. (lbs/day) (kg/day)						**62831** 28500		
TKN (lbs/day) (kg/day)								**5512** 2500

1. Calculated from COD x 1.6 determined from measurement
2. Not available yet – to be determined in laboratory once operational
3. Not appropriate to measure due to high fat concentrations
4. With additional aeration capacity

Section 3: Implementation of Treatment Processes

3.1 Current Construction Progress (April 2004)

For the upgraded system (PCDAF / EGSB / PA / SBR) the design and construction is ahead of the original schedule presented to the RWQCB in September 2003 and is as follows:

3.1.1 Equalization – EQ 1 and 2 are in place and operational. EQ 3 has been built and is currently being hydraulically tested and commissioned.

3.1.2 PCDAF – two DAF tanks with their associated primary flocculant and polymer mixing and injection systems have already been installed and are currently operational. The use of additional primary coagulant and flocculant can be progressed once the EGSB and SBRs are fully commissioned.

3.1.3 EGSB – construction of the system is virtually complete and loading of the live anaerobic inoculation cultures is underway – this will take some time, as the cultures have to arrive from a number of sources. Final system checking, PLC programming and finishing work is being completed. Commencement of commissioning is scheduled for the second half of May 2004. It is expected that once commissioning has been completed, and growth of the active biomass initiated then wastewater flows will gradually increase to full current flows by August 2004.

3.1.4 PA / SBRs – construction of the tanks has begun. Foundations have been laid and tank fabrication is due to begin on May 7th 2004. Completion of the tanks and commissioning should coincide with full current flow from the EGSB in August 2004.

3.1.5 RO / Evaporation – the current RO and evaporation system is operational on DAF outflow. Pipe work is being completed over the next two months to tie in SBR outflow to the RO feed tanks.

3.1.6 Solids Handling – the filter press is in place along with sludge holding tanks. The filter press is operational on DAF float. Local composting operations are receiving DAF float and filter cake. EBMUD are receiving DAF float and Evaporated RO concentrate. The filter press filtrate is returned to the equalization tanks for processing through PCDAF. Once the SBRs are commissioned the process technology will be progressed to be able to incorporate SBR and EGSB biosolids into the filter press operation.

3.1.7 Lipid Digester – the design of the lipid digester is underway and once completed it will be submitted for HCC's board approval. Construction of this is not expected until the EGSB / PA / SBRs have been completed and commissioned. Current planning has the lipid digester coming on line in the first quarter of 2005.

3.1.8 Soil Bed Biofilter – design of the biofilter has been completed and construction will be initiated in July 2004 once suitable materials are located and the area cleared from other construction activities.

3.1.9 Brine Disposal & Acid Reclaim – both these systems are in operation.

3.2 Use of Reverse Osmosis – reclaimed water applied to existing primary and secondary land

3.2.1 The existing reverse osmosis equipment is operational. It is intended to initially run the majority of the outflow from the SBRs through these prior to storage in the existing ponds. Given current knowledge, the estimated final concentrations of various components of interest are shown in the table 2 below. These values will require verification after the full system is operation, however they are based on best estimates from current data and membrane performance criteria from the manufacturers.

Table 2: Projected composition of wastewater processed through PCDAF/EGSB/SBR/RO

Constituent	Unit	Projected Value ex SBR	Projected Value ex RO
Ca	mg/L	25 - 50	1 - 2
Mg	mg/L	7 - 14	0.3 – 0.6
Na	mg/L	300	64
K	mg/L	50	14
$NH_4 - N$	mg/L	10	3
$NO_3 - N$	mg/L	2	1
HCO_3	mg/L	10 - 300	2 - 59
SO_4	mg/L	10	0.4
Cl	mg/L	410	80
SiO_2	mg/L	60	8
TDS	mg/L	1200	231
pH	Std Unit	6.5	5.2

3.2.2 At these concentration levels the outflow from the treatment process will meet reclaimed water status and the lesser of water quality objectives and background water quality – values of which will be proposed in the RWD. Given this water quality standard, HCC intends to continue irrigating the current primary and secondary fields covered by the monthly WDR, 550 acres (222) hectares with extension to additional lands along the Olson Ditch as required to ensure appropriate hydraulic loading rates.

3.2.3 As previously described, HCC does not believe that running the ROs supports long-term sustainability goals. Accordingly, the use of ROs on SBR outflow will only be continued until alternative irrigation areas are established. After that, the flow through the ROs will be diminished to a point where they are no longer utilized.

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